weed management entities to control or eradicate harmful, nonnative weeds on public and private land; to the Committee on Energy and Natural Resources.

By Mr. REID:

S. 199. A bill to amend title 49, United States Code, to authorize the Secretary of Transportation to oversee the competitive activities of air carriers following a concentration in the airline industry, and for other purposes; to the Committee on Commerce, Science, and Transportation.

By Mr. REID:

S. 200. A bill to establish a national policy of basic consumer fair treatment for airline passengers, and for other purposes; to the Committee on Commerce, Science, and Transportation.

By Mr. WARNER:

S. 201. A bill to require that Federal agencies be accountable for violations of antidiscrimination and whistleblower protection laws, and for other purposes; to the Committee on Governmental Affairs.

By Mr. WARNER:

S. 202. A bill to rename Wolf Trap Farm Park for the Performing Arts as ''Wolf Trap National Park for the Performing Arts''; to the Committee on Energy and Natural Resources.

SUBMISSION OF CONCURRENT AND SENATE RESOLUTIONS

The following concurrent resolutions and Senate resolutions were read, and referred (or acted upon), as indicated:

By Mr. NICKLES (for himself, Mr. DURBIN, Mr. FITZGERALD, Mr. GRAHAM, Mr. HAGEL, Mr. KYL, Mr. INHOFE, and Mr. BINGAMAN):

S. Con. Res. 4. A concurrent resolution expressing the sense of Congress regarding housing affordability and ensuring a competitive North American market for softwood lumber; to the Committee on Finance.

STATEMENTS ON INTRODUCED BILLS AND JOINT RESOLUTIONS

By Mr. BINGAMAN (for himself, Mr. CRAIG, Mr. SCHUMER, and Mrs. MURRAY):

S. 193. A bill to authorize funding for Advanced Scientific Research Computing Programs at the Department of Energy for fiscal years 2002 through 2006, and for other purposes; to the Committee on Energy and Natural Resources.

Mr. BINGAMAN. Mr. President, I rise today to introduce a bill authorizing the Secretary of Energy to provide for the Office of Science to develop a robust scientific computing infrastructure to solve a number of grand challenges in scientific computing. This bipartisan bill, which is referred to as the ''Department of Energy Advanced Scientific Computing Act'' is co-sponsored by Senators CRAIG, SCHUMER, and MURRAY. Before discussing this program in detail, let me briefly frame the proposed effort. First, I will outline the tremendous advances made in the last decade for scientific computing. Second, I will give a few examples of the ''grand challenges'' in scientific computing. Third, I will discuss how the proposed program at the Office of Science will give our nation's scientists the tools to meet these grand challenges. I will conclude by demonstrating how this program integrates with defense related computing programs at the DOE and across the interagency.

Experts agree that scientific computing R&D is at a critical juncture. If the breakthroughs proceed as predicted, the information age could affect our everyday lives far beyond what we nonexperts currently grasp. It is terribly important that we, as a nation, ensure that the U.S. maintains a leadership role in scientific computing R&D. If we fall behind in this rapidly changing field, our nation could lose its ability to control the national security, economic and social consequences from these new information technologies.

What are the possible breakthroughs in scientific computing that merit such strong programmatic attention? Within the next five years we expect that advanced scientific computing machines will achieve peak performance speeds of 100 teraflops or 100 trillion arithmetic operations per second; that is 100 times faster than today's most advanced civilian computers. To put things in perspective, the fastest Pentium III available today can perform about 2 gigaflops (2 billion operations per second), so a 100 teraflops machine is about 50,000 times faster than today's fastest Pentium III. We call this new wave of computing ''terascale computing''. This new level of computing will allow scientists and engineers to explore problems at a level of accuracy and detail that was unimaginable ten years ago. I will discuss the scientific and engineering opportunities in more detail later. First, let me discuss some of the challenges in terascale computing.

The major advance that led to terascale computing is the use of highly parallel computer architectures. Parallel computers send out mathematical instructions to thousands of processors at once rather than waiting for each instruction to be sequentially completed on a single processor. The problem we face in moving to terascale computers is writing the computer software that utilizes their full performance capabilities. When we say ''peak'' speeds we mean the ability to use the full capability of the computer. This happens very rarely in parallel computers. For example, in 1990 on state-of-the-art Cray supercomputers with about eight processors, we could obtain, on the average, about 40–50 percent of the computer's ''peak'' speed. Today, with massively parallel machines using thousands of processors, we often obtain only 5–10 percent of the machine's ''peak'' speed. The issue is how to tailor our traditional scientific codes to run efficiently on these terascale parallel computers. This is the foremost challenge that must be overcome to realize the full potential of terascale computing.

Another problem we face as we move to terascale computing is the amount of data we generate. Consider the following. Your PC, if it is one of the latest models, has a hard drive that will hold about 10 gigabytes of data. If we successfully begin to implement terascale computing, we will be generating ''petabytes'' of data for each calculation. A petabyte of data is one million gigabytes or the equivalent of 100,000 hard drives like the one on your PC. A teraflop machine user will make many runs on these machines. But raw data isn't knowledge. To turn data into knowledge, we must be able to analyze it—to determine what it is telling us about the phenomena that we are studying. None of the data management methods that we have today can handle petabytes data sets. This is the second challenge that must be overcome.

And, many more challenges exist.

To make effective use of today's and the future's computing capability we need to establish a scientific program that is radically different from what researchers are used to today. Future scientific computing initiatives must be broad multi-disciplinary efforts. Tomorrow's scientific computing effort will employ not only the physicist who wishes to probe the minute details of solid matter in order to say, built a better magnet, it will include a computer scientist to help ensure that the physicist's software makes efficient use of the terascale computer. Terascale computing will also require mathematicians to develop specialized routines to adapt the solution of the physicist's mathematical equations to these parallel architectures. Finally, terascale computers will require specialists in data networking and visualization who understand how to manage and analyze the massive amounts of data.

I note these problems to highlight the complexities of tomorrow's scientific computing environment from the common information technologies that we employ today. However, because computing technology moves at such a rapid rate, elements of the issues that I have described will surely impact us in the near future. Given the impact information technologies have had only in ten years, it is important that we, as a nation, lead the initiative in these breakthroughs so that we can positively control the impact that the these revolutionary technologies will have on our economy and the social fabric of our Nation.

What are the important problems that we expect terascale computing to address? We call these problems ''Grand Challenges''. Terascle computing will enable climate researchers